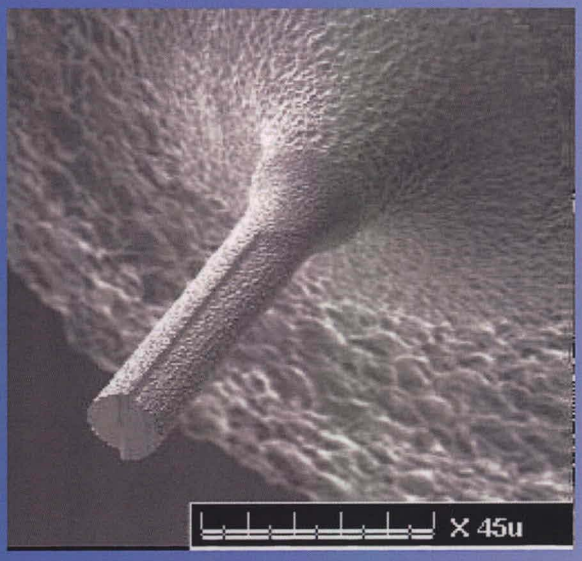
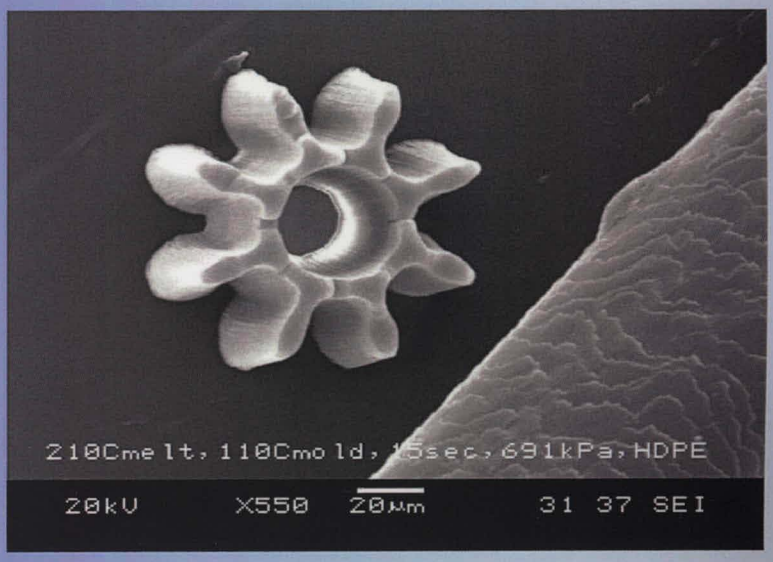
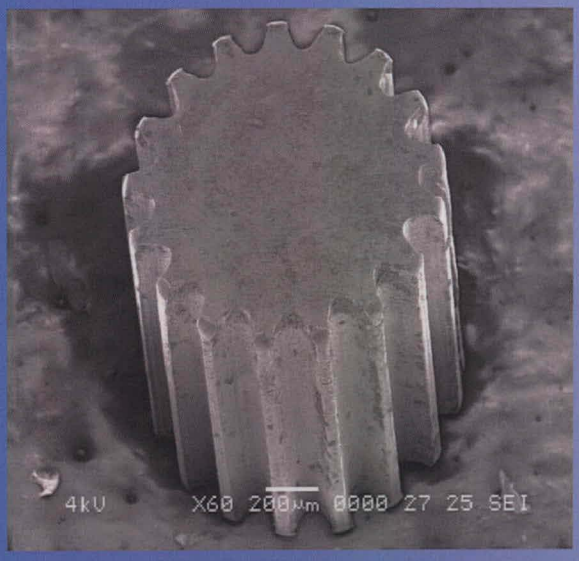
Advanced Machining Process







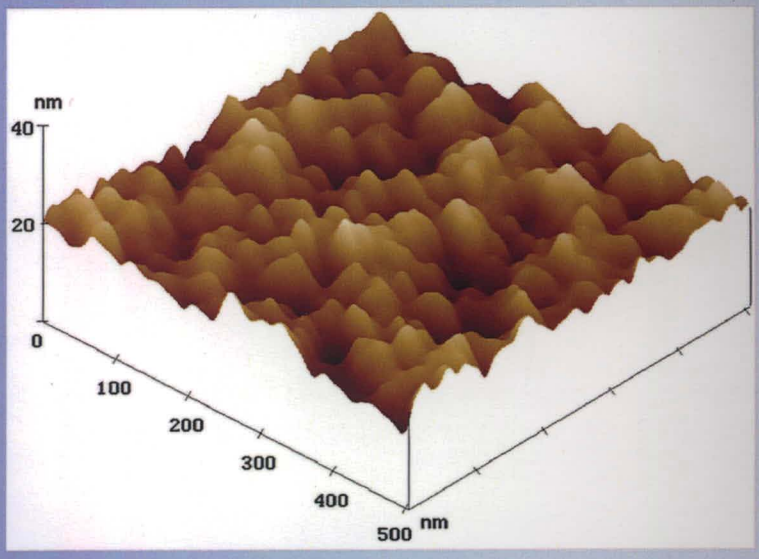


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Table of Contents

Chapter 20

Micro/Meso Milling of Aluminium Alloy 1100: Analysis and Modelling of Minimum Chip Thickness

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Keywords: Micromilling, Chip formation, minimum chip thickness, Aluminium alloy

Abstract. This project discusses the modelling aspect of minimum chip thickness in micro/meso milling. The chip thickness models are formulated in term of micromilling parameters such as feed rate, cutting speed and depth of cut with the minimum chip thickness. Twenty seven experiments were conducted on work material aluminium alloy 1100 by using tungsten carbide tool of diameter 1.0 mm. Scanning electron microscope (SEM) was used to determine the chip thickness. Design Expert software is used to analyze the result by using ANOVA with 2FI model. By this model, two terms were identified as significant which are speed and depth of cut while feed rate and other combinations were used to obtain optimum combination to get minimum chip thickness. From the optimization, the value of chip thickness is 5.75 μm with 98% desirability for 3 mm/min feed rate, 3000 rpm speed and 5 μm depth of cut.

Experiment

The selections of the material in this experiment are divided into two. First is tool material which is tungsten carbide and second is work material which is aluminium alloy 1100. This subsection is going to explain briefly about the properties, characteristics and applications of these two materials selected. An example of micromilling tool is shown in Figure 1.

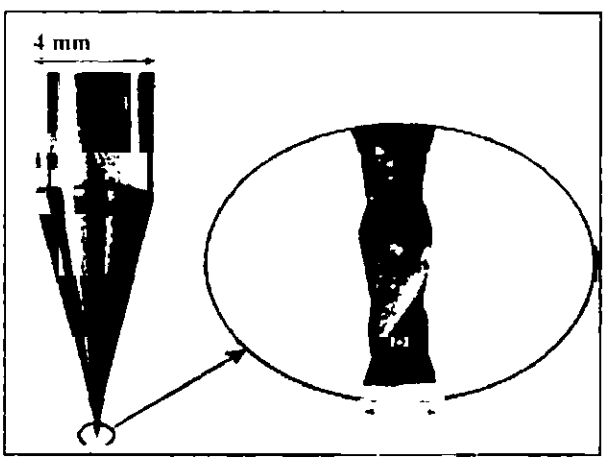

Fig. 1 Tungsten carbide micromilling tool [1]